We claim:

1. A method for controlling a clutch that driveably connects an input and an output, the method comprising the steps of:

producing input torque at the clutch;

operating the clutch partially engaged;

calculating the temperature of the clutch;

establishing a reference clutch temperature;

comparing the calculated clutch temperature and reference clutch temperature; and

if the calculated clutch temperature equals or exceeds the reference clutch temperature, then increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch.

2. The method of claim 1, wherein the step of operating the clutch in a partially engaged condition includes the steps of:

determining the current clutch slip;

establishing a first desired portion of the input torque to be transmitted by the clutch to the second output;

determining a first magnitude of clutch torque corresponding to the first desired portion;

determining a second magnitude of clutch torque to be transmitted to the second output in proportion to the current clutch slip; and

changing the magnitude of torque transmitted by the clutch to the sum of the first and second magnitudes.

3. The method of claim 1, wherein the step of then increasing the degree of clutch engagement over a period sufficient to reduce the calculated temperature of the clutch includes the step of fully engaging the clutch.

4. The method of claim 1, wherein the step of calculating the temperature of the clutch, includes the steps of:

repetitively calculating the change of temperature of the clutch over successive time intervals; and

maintaining a running total of the change of clutch temperature over each interval.

5. The method of claim 4, wherein the step of repetitively calculating the change of temperature of the clutch, includes the steps of:

repetitively calculating the differential change in power transmitted by the clutch over successive intervals;

determining the thermal mass of the clutch; and

dividing the differential change in power transmitted by the clutch over an interval by the thermal mass of the clutch.

6. The method of claim 5, wherein the step of repetitively calculating the differential change in power transmitted by the clutch over a time interval, includes the steps of:

repetitively determining the magnitude of power transmitted to the clutch input over successive intervals;

repetitively determining the magnitude of power transmitted from clutch output over successive intervals; and

repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

7. The method of claim 6, wherein the step of repetitively determining the magnitude of power over an interval at the clutch output, includes the steps of:

determining the clutch gain;

repetitively determining the magnitude of pressure at the clutch servo at successive intervals;

repetitively determining the speed of the clutch output at successive intervals; and

repetitively calculating the product of clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

8. The method of claim 7, wherein the step of determining the clutch gain, includes the steps of:

determining the average coefficient of friction of a friction disc-spacer plate pair located in the clutch;

determining the number of disc-plate pairs in the clutch;

determining the effective friction area of the disc-spacer pairs;

determining the effective radius of the frictional area of the disc-plate pairs from the axis about which the clutch rotates; and

calculating the product of said the average coefficient of friction, said number of disc-plate pairs, said effective friction area, and said effective radius.

9. The method of claim 1, further comprising the step of:

establishing a threshold clutch temperature that is higher than the reference clutch temperature;

comparing the calculated clutch temperature and threshold clutch temperature; and

if the calculated clutch temperature equals or exceeds the threshold clutch temperature, then fully engaging the clutch.

10. A method for controlling, with the aid of a digital computer, a clutch through which a clutch input and a clutch output are driveably connected, the method comprising the steps of:

inputting to and executing in the computer a computer readable program code algorithm for operating the clutch partially engaged;

providing the computer with a data base including at least a reference clutch temperature;

providing a signal in the computer responsive to the beginning of execution the algorithm;

initializing in the computer in response to the signal a running arithmetic sum;

repetitively calculating in the computer at frequent intervals during execution of the algorithm the change of temperature of the clutch during each interval;

repetitively updating in the computer the running sum with the calculated change of clutch temperature over each interval;

repetitively comparing in the computer at frequent intervals the reference clutch temperature and the magnitude of the running sum; and

if the magnitude of the running sum equals or exceeds the reference clutch temperature, issuing a command from the computer causing an increase in the degree of clutch engagement sufficient to reduce the magnitude of the running sum.

11. The method of claim 1, wherein the step of issuing a command from the computer further comprises:

terminating execution in the computer of the algorithm; and

issuing a command from the computer causing the clutch to become fully engaged.

12. The method of claim 11, further comprising the step of:

providing the computer with a data base including the thermal mass of the clutch; and

wherein the step of repetitively calculating the change of temperature of the clutch includes the steps of repetitively calculating in the computer at frequent intervals:

the differential change in power transmitted by the clutch over successive intervals;

determining the thermal mass of the clutch; and

dividing the differential change in power transmitted by the clutch over an interval by the thermal mass of the clutch.

13. The method of claim 12, wherein the step of repetitively calculating the differential change in power transmitted by the clutch over a time interval includes the steps of repetitively calculating in the computer at frequent intervals:

repetitively calculating in the computer the magnitude of power transmitted to the clutch input over successive intervals;

repetitively calculating in the computer the magnitude of power transmitted from clutch output over successive intervals; and

repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

14. The method of claim 13, further comprising the steps of:

providing the computer with a data base including a clutch gain; and

repetitively providing the computer at frequent intervals with input representing a magnitude of pressure at the clutch servo, and a speed of the clutch output; and

wherein the step of repetitively calculating the magnitude of power over an interval at the clutch output includes the step of repetitively calculating in the computer at frequent intervals:

the product of the clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

15. The method of claim 14, further comprising the step of:

providing the computer with a data base including the average coefficient of friction of a friction disc-spacer plate pair located in the clutch, the number of said disc-plate pairs, the effective friction area of the disc-spacer pairs, and the effective radius of the frictional area of the disc-plate pairs from the axis about which the clutch rotates; and

wherein the step of repetitively calculating the clutch gain includes the step of calculating the product of said average coefficient of friction, said number of disc-plate pairs, said effective friction area, and said effective radius.

16. The method of claim 14, further comprising the steps of:

providing the computer with a data base including a threshold clutch temperature that is higher than the reference clutch temperature; and further comprising the steps of:

comparing the calculated clutch temperature and threshold clutch temperature; and

if the calculated clutch temperature equals or exceeds the threshold clutch temperature, then fully engaging the clutch.

17. In a transfer case having first and second outputs, a system for controlling a clutch that driveably connects the first output and second output, comprising:

means for operating the clutch partially engaged;

means for calculating the temperature of the clutch;

establishing a reference clutch temperature;

means for comparing the calculated temperature of the clutch and reference clutch temperature; and

means for producing an output signal for increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch, if

the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

18. The system of claim 17, wherein the output signal producing means fully engages the clutch if the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

19. The system of claim 17, further comprising:

a fluid pressure source;

a servo through which the clutch is alternately pressurized and vented to engage and disengage the clutch; and

a solenoid communicating with the output producing means for increasing a magnitude of pressure in the servo in responsive the output signal.